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Rotatoria and Crustacea plankton of the River Danube between Bratislava and Budapest

by
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Abstract: This paper summarizes the results of the Rotatoria, Cladocera and Copepoda surveys on the River Danube between Bratislava and Budapest in the period of 1992-1994. Qualitative and quantitative zooplankton investigation was conducted with bi-weekly sampling frequency. Analysis is given on the temporal and spatial changes of the species composition and individual abundances of the populations. During these investigations the presence of some 148 Rotatoria and Crustacea species were revealed.
Key words: River Danube, Rotatoria, Cladocera, Copepoda, qualitative, quantitative investigations

Literature survey

The first investigations of Rotatoria fauna on this particular Danube section were conducted in 1944, when 46 species and forms belonging to 16 genera were described (Woynarovich 1944). More detailed recording of the mesofauna has started in 1958 headed by Dudich (1967). In the framework of this study Kertész conducted a year-long survey at 12 points of the Hungarian Danube section with regards to the Rotatoria communities. In addition to these, he conducted longitudinal and daily investigations at the area of Budapest. These studies revealed the presence of 129 species belonging to 27 genera (Kertész 1963, 1967).

Czechoslovakian researchers started to investigate the Rotatoria and Crustacea communities at this particular Danube section only from the middle sixties. Detailed analyses were presented on the temporal and spatial changes of the species composition and abundance of the populations. Many new Crustacea species were described for the Danube (Ertl 1965, Vranovszky 1969, 1972, 1974a, b, 1978, 1985, 1994).

Studies of the Crustacea plankton were much more detailed. Ponyi (1962) has investigated this particular river section, that was followed by a summarizing volume edited by Liepolt (1967). The aim of this book was to summarize the state-of-the-research at that time.

A new period has started in the investigation of the Crustacea fauna of the Danube and its tributaries when Bothár joined to the research. In 1967–68 she investigated Cladocera and Copepoda communities of the Danube between the 1695–1656 rkms, in 1976 between 1707-1656 rkm at 3-3 sampling points monthly. She found at the former river section 20 Cladocera and 7 Copepoda species, while on the latter one 25 Cladocera and 14 Copepoda (Bothár 1978–79). She has conducted more frequent sampling at the 1669 rkm section near Göd, where the qualitative and quantitative composition of Entomostraca fauna were investigated between 1965-85 at weekly intervals. In summarizing her findings, she concluded that on this particular river section altogether 52 Cladocera and 26 Copepoda species were identified. From the Hungarian section of the watershed of the River Danube she identified

nearly 70 Cladocera and more than, 40 Copepoda species (Bothár & Ponyi 1968, Bothár 1968, 1975, 1985, 1988).

In the framework of the International Danube River Expedition in March 1988 the Danube Rotatoria and Crustacea plankton was investigated at 35 sampling points. From these we have investigated 3 sites: 1869, 1819, 1694 rkms. On the basis of this series of investigation Naidenov & Sevcova (1991) identified 59 Rotatoria, 13 Cladocera and 9 Copepoda taxa, while Pujin (1991) indicated the presence of 28 Rotatoria, 3 Cladocera and 5 Copepoda species. According to the latter author the Hungarian Danube section is characterized by the presence of 21 Rotatoria, 2 Cladocera and 3 Copepoda species. For the evaluation of these results, however, one has to consider the very unfavorable early spring conditions for sampling.

The investigation of the zooplankton communities of the Danube between Rajka-Budapest at our Institute has started in 1981. In the first period the primary aim was to establish a baseline data set for preliminary investigation. Later on the scope of the research somewhat changed, to investigate the interaction between the planktonic communities and hydrological conditions and of hydrobiological state (Gulyás, 1990a, b, 1994a, b, c, Forró & Gulyás 1992).

Material and methods

Within the frame of the investigations of the Hungarian-Slovakian border waterways financed by the Hungarian Ministry of Environment and Regional Policy research has started in 1992 with regards to the species composition and abundance of Rotatoria and Crustacea plankton. The Danube was sampled at 8 locations between Bratislava and Budapest at bi-weekly intervals. Samples were taken from the middle of the river to achieve a characteristic plankton sample. Collection of the samples therefore, was carried out from ships, ferries, from bridges and from different hydraulic constructions.

Samples were taken from the surface and filtered through a 60 μm mesh size plankton net. Volume of the filtered water was 50 liters each. The filtrate was conserved on-site by using 40% formaldehyde solution to achieve a final concentration of 4%, occasionally lugol (iodine) solution was also used. For the taxonomic determination of the animals identification keys by Bancsi (1986, 1988), Gulyás (1974), and Dévai (1977) were used. Taxa lists were prepared on the basis of the above cited manuals (see Appendix). Quantitative samples were counted by using Utermöhl plankton counter microscope, with 5 ml counting chambers.

Sampling sites were the following:

1. Bratislava, middle of river	(Br)	1869,0 rkm
2. Rajka, right side	(Rj)	1848,4 rkm
3. Rajka, left side (Hrusov)	(Rb)	1864,0 rkm
4. Medve, middle of river	(Me)	1805,5 rkm
5. Komárom, middle of river	(Ko)	1868,3 rkm
6. Szob, middle of river	(Sz)	1708,0 rkm
7. Nagymaros, middle of river	(Nm)	1694,6 rkm
8. Budapest, Surface Water Works	(Bp)	1659,0 rkm

Evaluation of the results

Qualitative composition of Rotatoria and Crustacea plankton communities

Analysis of the plankton samples revealed the occurrence of altogether 148 zooplankton taxa. Largest species and individual numbers were almost always connected to the Rotatoria

species (95), while Copepoda (17 species) and Cladocera (36 species) were represented in smaller numbers. Table 1 shows the yearly changes of species number of different groups.

Table 1. Changes in species numbers of different taxonomic groups

	1992	1993	**1994**
Rotatoria	71	62	64
Copepoda	11	14	11
Cladocera	28	25	20
Sum	110	91	95

Occurrence of several rare species was also recorded having importance from faunistical point of view. These are: *Brachionus diversicornis homoceros, Dicranophorus prolectes, D. uncinatus, Elosa worallii, Euchlanis triquetra, Lecane stichae, L. stokesii, Lepadella quadricarina, Lindia torulosa, Ptygura melicerta, Eurytemora velox, Alona intermedia, Bosmina coregoni, Daphnia galeata, Monospilus dispar*.

Species composition of the Rotatoria and Crustacea plankton communities of the Danube is dominated by the presence of Rotatoria species, from which *Brachionus angularis, B. calyciflorus, Filinia longiseta, Keratella cochlearis, K. cochlearis tecta, K. quadrata* and *Polyarthra vulgaris* occurred in almost all the samples. Amongst the microcrustaceans near dominant were only the larvae of copepods.

With smaller relative frequency but in many places, the following taxa were identified: *Asplanchna priodonta, Brachionus budapestinensis, B. leydigi tridentatus, B. quadridentatus, B. urceolaris, Cephalodella gibba, Euchlanis dilatata, Kellikottia longispina, Notholca acuminata, N. squamula, Synchaeta pectinata, Testudinella patina, Acanthocyclops robustus* f. *limnetica, A. vernalis, Mesocyclops leuckarti, Thermocyclops oithonoides, Alona rectangula, Bosmina longirostris, Chydorus sphaericus, Daphnia longispina, Diaphanosoma brachyurum, Disparalona rostrata*. These species form the characteristic plankton of slow flowing or near-stagnant eutrophic waters, occurring occasionally in large numbers.

Zooplankton communities of the Danube between Bratislava and Budapest can be characterized and described by the dominant and frequently occurring Rotatoria and Crustacea species: *Brachionus angularis – B. calyciflorus – Filinia longiseta – Keratella cochlearis – K. cochlearis tecta – Polyarthra vulgaris – Acanthocyclops robustus* f. *limnetica – Bosmina longirostris.*

Smallest species number was found at the Bratislava cross-section (1869.0 rkm) during the investigated 3 years, species number varied between 42–46. Also, species diversity of the community was the lowest at this particular sampling site. Species composition is characterized by Rotatoria dominance, the crustaceans were represented in smaller numbers (3–10). Amongst the rare species *Dipleuchlanis propatula, Lecane flexilis, L. stichae, L. stokesi, Notholca labis, Eurytemora velox, Bosmina coregoni* and *Monospilus dispar* were recorded. Investigations revealed the occurrence of dominant species characteristic to the other sections of the River Danube. The fast flowing character of the river is unfavorable for the establishment of a species rich zooplankton community.

Near to Rajka, samples were taken from the right side (1848.4 rkm) and at Hrusov left side (1864.0 rkm). No significant differences could be found neither in the number of the taxa present nor in the species composition between the two banks. Taxon numbers of Rotatoria and Crustacea plankton communities varied between 39-61 in the investigated time period. Species number of zooplankton sharply decreased after the river was diverted in Slovakia in

October 1992. Between the end of October 1992 and early January 1993 only 18 species were recorded between Rajka-Medve. From February on, however, species number showed a continuous increase, and after this period no measurable differences were found. With the exception of 1992, species diversity of the communities was larger than of the Bratislava sampling site. Rare species were the following here: *Brachionus quadridentatus cluniorbicularis, B. quadridentatus melheni, B. rubens, Elosa worallii, Keratella hiemalis, K. quadrata frenzeli, K. testudo, K. valga, Lecane ludwigii, L. quadridentata, L. ungulata, Lepadella ovalis, L. quadricarinata, Lindia torulosa, Paradicranophorus hudsoni, Ptygura melicerta, Trichocerca cylindrica, Trichotria tetractis, T. truncata, Eucyclops macrurus, E. speratus, Alona guttata, Daphnia galeata, Graptoleberis testudinaria, Peracantha truncata.* Increase in the number of Crustacea taxa was observed, many of them are not euplanktonic species, but thrive in the littoral zone and macrophyte vegetation. The possible reason for this are the decreasing water velocities – due to smaller flows – providing better habitat for the filter feeder (grazing) species. It is interesting to note the occurrence of *Daphnia magna* that was drifted away from some Austrian water reservoir.

At Medve (1805.5 rkm) the water flow of the Danube is unified. Taxon number here changed between 52–64, representing a rich community. Rare species at this particular location were: *Brachionus budapestinensis punctatus, B. diversicornis homoceros, B. plicatilis, Dicranophorus prolectes, Epiphanes macrourus, Keratella tropica, Lindia torulosa, Mytilina bisulcata, Alona costata.* Here also, the crustaceans are represented with relatively large numbers, many of them are so-called tichoplanktonic species. Each year dominated Rotatoria species which are characteristic for slowly flowing waters. Species composition of the communities did not show significant difference compared to upstream sampling sites.

At Komárom (1768.3 rkm) species diversity increased further, taxon number varied between 54-69. Largest species number was found in 1993. Most of all the number of Rotatoria taxa increased, rare species and accompanying species number has not changed. Dominance of (*Brachionus, Filinia, Keratella, Polyarthra, Acanthocyclops, Bosmina, Daphnia, Diaphanosoma*) genera characteristic to slow-flowing and stagnant waters is evident here. Increase in species diversity of the zooplankton community is due to the decreasing flow velocities providing better conditions for the zooplankton species.

The richest community was found at Szob (1708.0 rkm). Taxon number varied throughout the three years in the range of 55-69. Species richness is largely due to the effect of smaller tributaries (Garam, Ipoly) only a few kilometers upstream of the sampling site. New rare species are: *Asplanchna brightwelli, Brachionus quadridentatus rhenanus, Epiphanes macrourus, Euchlanis triquetra, Lecane ludwigi, L. ungulata*, moreover a large number of littoral and benthic species, such as *Diacyclops bicuspidatus, Eucyclops macruroides, E. serrulatus, Megacyclops viridis, Alona affinis, A. rectangula, Disparalona rostrata, Iliocryptus agilis, I. sordidus, Macrothryx hirsuticornis, M. laticornis, Simocephalus vetulus* presence of which increased the species diversity. Dominant were always planktonic Rotatoria and Crustacea species characteristic to the River Danube.

The Nagymaros sampling site (1694.6 rkm) is only 14 river kilometers downstream of the previous one. Taxon number varied between 49-71 during the three years. No larger differences were found between the two sampling points with regards to the occurrence of neither the rare, nor the dominant species. No significant changes were revealed on the basis of the species composition of the communities.

The Budapest sampling site was selected on the left-side of the river, upstream of the city (1659.0 rkm). Species number varied between 47–67 in 1992–1994. Dominant species were

in all cases Rotatoria, Crustacea were represented generally at lower species number, compared to the two previous upstream sampling sites. New rare species, in addition to the previously listed were: *Dicranophorus uncinatus*, *Keratella cochlearis macracantha*, *K. cochlearis micracantha* and *Daphnia galeata*. Dominant taxa were identical with the previous sampling sites. On the approximately 35 rkm long river section no water quality changes can be observed on the basis of the species composition of zooplankton communities.

Quantitative composition of Rotatoria and Crustacea plankton communities

Abundance of the animals changed between 12-6648/100 liters in the river section of Bratislava-Budapest in the period of 1992–1994 (Figs 1–3). In general, it is concluded that values are showing a constant increase in the downstream direction. The degree of this increase was still slight in 1992, while in 1993 and 1994 this trend was more expressed. In certain seasons the abundance was especially high downstream of Medve, and at Szob and Nagymaros. River section downstream of Medve has lowered water velocities providing better environmental conditions for the formation of communities usually observed at high abundance, with eutrophic water species, such as *Brachionus, Filinia, Keratella, Polyarthra, Acanthocyclops, Bosmina, Daphnia, Diaphanosoma, Moina*. As it can be seen from the figures and tables, largest values were measured in the above named sampling points in May and September of 1992, and also in May and June of 1993. Individual abundance of the animals were noticeably less in 1994, than in the two previous years.

These phenomena – longitudinal increase of individual abundance values, and large individual number of a few species – indicate an increasing eutrophication process in the River Danube.

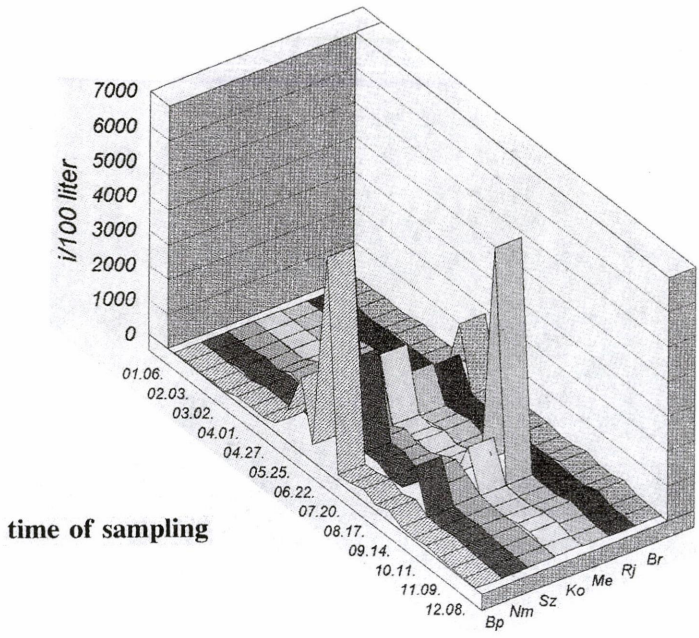

Fig. 1. Longitudinal changes of the Rotatoria and Crustacea fauna of the River Danube in 1992

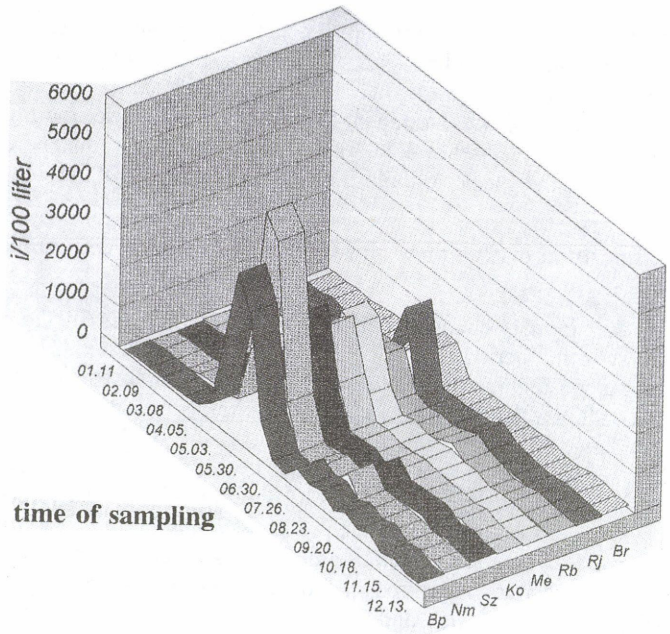

Fig. 2. Longitudinal changes of the Rotatoria and Crustacea fauna of the River Danube in 1993

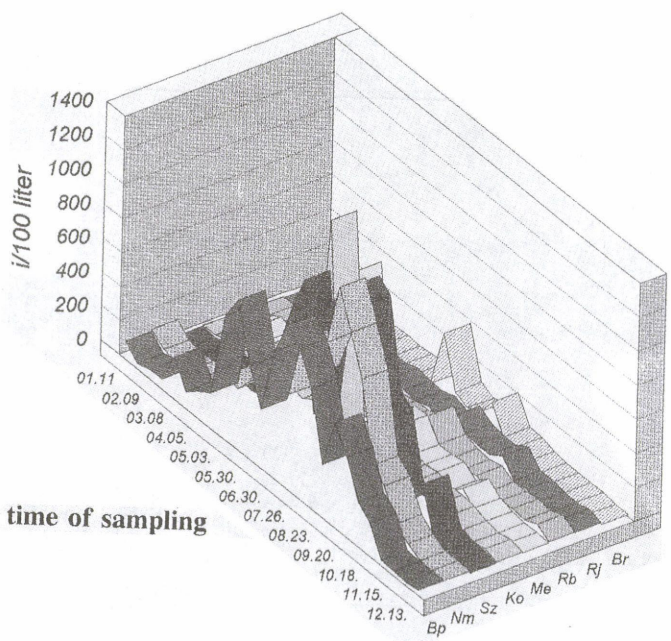

Fig. 3. Longitudinal changes of the Rotatoria and Crustacea fauna of the River Danube in 1994

At the Bratislava sampling site the abundance varied between 30-1874/100 l in 1992, was 20-756/100 l in 1993, while its value in 1994 was only 12-382/100 l. First maxima were measured by the end of April – early May, that was accounted for some large population of *Brachionus*, *Keratella* and *Polyarthra* species. This is followed by a smaller population peak in July and August. In the investigated overall river section the smallest abundances were measured here in three consecutive years, averaging about 168 in 1992, 163 in 1993, and finally 58 in 1994.

Compared to the upstream sampling location, the Rajka and Hrusov sampling sites only showed increase in abundance in 1993. In this year the number of individuals per 100 liter varied between 26-2064, and 40-1090 (yearly averages: 256 and 272). In the other two years similar values were measured to the Bratislava sampling point (yearly averages: 128 and 53). Alteration of the flow of the Duna water in the fall of 1992 was followed by an expressed decrease in abundance, which continued until the spring of 1993. Thereafter no significant differences were observed in the abundance values at the altered river section. Abundance maxima were observed at late spring and early summer (April-June), and also in late summer early autumn (July-September). In prolonged small water periods, usually early September, apart from the Rotatoria some plankton species were becoming also highly abundant (*Bosmina longirostris, Daphnia cucullata, Diaphanosoma brachyurum, Thermocyclops oithonoides*).

Downstream of the diverted section, at Medve a well-expressed increase in abundance was observed. This was especially characteristic in 1992. In this year number of individuals per 100 liters varied between 62-6648 in the vegetation period, yearly average was 413. Large values were due to *Daphnia cucullata* and *Thermocyclops oithonoides* individuals. In 1993 no such maximum was observed, (maximum value was 2259 ind./100 liter), but average values were similarly high (373 ind./100 liter). All over 1994 smaller individual numbers were found (yearly average 105 ind./100 liter), but in the vegetation period the populations were three-four times larger, than at the altered river section. Maximum periods in individual numbers were more prolonged, from early March until the middle of June, that was followed with a smaller peak from the middle of July till the end of October.

As a result of further decreasing water flow velocities downstream of Medve individual numbers at Komárom also showed a further increase (255 in 1992, 405 in 1993, 106 in 1994 ind./100 liters). In the periods between March and October the individual numbers were usually 2–3 times higher here, compared to the values at Medve. The numbers of individuals per 100 liters in the vegetation period of 1992 were 140-1894, in 1993 96-2384, while in 1994 36-1224 were detected. These increasing tendencies are clearly visible in Figs 1–3. Large numbers are due to the Rotatoria, and larvae of Copepoda characteristic to eutrophic waters.

Largest numbers of individuals were found at Szob and Nagymaros sampling sites. Individual numbers per 100 liter about 1000 and above were characteristic for several months. Even at early spring and late fall larger Rotatoria and Crustacea populations were found here, than at upper river sections. This tendency is clearly shown by the yearly averages at Szob in 1992: 236, 1993: 456, 1994: 334, while at Nagymaros: 1992: 533, 1993: 712, 1994: 343 ind./100 liter. It can also be seen in the figures, that opposite to the formerly described sections – large individual numbers are formed in the second half of the year and at early spring and early summer.

Individual numbers of Rotatoria and Crustacea populations at the sampling point upstream of Budapest were similar to that of Nagymaros. No significant increase was observed on this 35 rkm long river section. Yearly average individual numbers were 501 in 1992, 619 in 1993, and 344 ind./100 liter in 1994. Population dynamics showed similar pattern to the upper sections.

Summary

Survey of the River Danube between Bratislava and Budapest in the period of 1992–1994 included 8 sampling sites where bi-weekly sampling of the Rotatoria and Crustacea plankton communities was carried out. Occurrence of 148 species was recorded, rotatorians dominated, among which *Brachionus angularis, B. calyciflorus, Filinia longiseta, Keratella cochlearis, K. cochlearis tecta, K. quadrata* and *Polyarthra vulgaris* were found at almost every sampling site. Among the Crustacea most frequent were *Acanthocyclops robustus* f. *limnetica* and *Bosmina longirostris*, and copepod larvae. We have recorded many rare species, which are interesting from faunistical point of view as well.

Frequently occurring Rotatoria and Crustacea species are characteristic to the planktonic communities of eutrophic stagnant and slow-flowing rivers.

Species compositions of the investigated communities were the poorest at Bratislava showing a constant enrichment towards the downstream sampling sites. No significant changes were found in species composition of the community within the investigated time period. In samples taken from the middle of the river occurrence of non planktonic species was frequently observed. These organisms are rather characteristic to the littoral zone or the upper layer of the sediment.

The abundance of the Rotatoria and Crustacea plankton was the highest in 1992, decreased by 1993, and has shown a further gradual decrease in 1994. The number of individuals increased longitudinally downstream, but both the rare and the dominant species were almost identical at every sampling site. Largest populations were found at Szob, Nagymaros and Budapest. Two population peaks were observed every year, from which the spring-early summer is larger followed by a smaller late summer-early fall population maximum.

Increase of the abundance of the zooplankton community downwards of the river raise the concern of the ongoing eutrophication processes.

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Appendix: Rotatoria and Crustacea fauna of the River Danube in 1992-1994

TAXA	Br	Rj	Rb	Me	Km	Szo	Nm	Bp
ROTATORIA								
Anuraeopsis fissa (Gosse)		•		*			#	#
Ascomorpha ecaudis (Perty)	# * •	# * •	* •	# •	# *	# *	# *	# * •
Asplanchna brightwelli (Gosse)			*	#	# •	*		*
A. priodonta (Gosse)	* •	# * •	# * •	* •	# * •	# * •	* •	# * •
A. sieboldi (Leydig)					*		*	
Bdelloidea sp.	# * •	# * •	# * •	# * •	# * •	# * •	# * •	# * •
Brachionus angularis Gosse	# * •	#				# * •	# * •	# * •
B. a. bidens (Plate)					*	# •		•
B. budapestinensis Daday	# •	# * •	* •	# * •	# * •	# * •	# * •	# * •
B. b. punctatus (Hempel)				#				
B. calyciflorus calyciflorus (Pallas)	# * •	# * •	# * •	# * •	# * •	# * •	# * •	# * •
B. c. anuraeiformis (Brehm)	* •	# *	* •	* •	* •	# *	# * •	# * •
B. c. amphiceros Ehrb.	# * •	# * •	# * •	# * •	* •	# * •	# * •	# * •
B. c. dorcas (Gosse)	#	#		#	# *	# *	*	# *
B. c. spinosus (Wierzejski)				•	# *	* •	•	
B. diversicornis (Daday)	*	* •	* •	*	*	*	* •	*
B. d. homoceros Wierzejski		#		# *	*			
B. leydigi leydigi Cohn	* •	*	* •	* •	* •	*	*	
B. l. rotundus Rousselet			#					
B. l. tridentatus (Sernov)	# * •	# * •	* •	# * •	# * •	# * •	# * •	# * •
B. plicatilis plicatilis O.F.M.		#		#	#	#	#	
B. quadridentatus quadridentatus (Hermann)	# * •	# *	# *	# * •	# *	# * •	# * •	# * •
B. q. ancylognathus (Schmarda)	#			#	#	#		
B. q. brevispinus (Ehrb.)	# *	* •	# * •	* •	* •	* •	# * •	# * •
B. q. cluniorbicularis (Skorikov)	*	*		*	*	* •	* •	# * •
B. q. melheni (Barrois et Daday)			*					
B. q. rhenanus (Lauterborn)						#		
B. rubens EHRB.			# *	*	# *	# *	*	*
B. urceolaris O.F.M.	# * •	# * •	# * •	# * •	* •	# * •	# * •	# * •
Cephalodella gibba (Ehrb.)	# * •	# •	* •	# *	* •	# * •	# * •	# * •
Cephalodella sp.	#	*	#			•	•	
Conochilus unicornis Rousselet							#	
Dicranophorus prolectes Harring et Myers				#				
D. uncinatus (Milne)								*
Dipleuchlanis propatula (Gosse)	*			•			*	
Elosa worallii Lord		#	•					
Epiphanes macrourus (Barrois et Daday)					#	#		
Euchlanis dilatata Ehrb.	# *	# * •	# * •	# * •	# * •	# * •	# * •	# * •
E. triquetra Ehrb.				•		#		

TAXA	Br	Rj	Rb	Me	Km	Szo	Nm	Bp
Filinia longiseta (Ehrb.)	# * •	# * •	# * •	# * •	# * •	# * •	# * •	* •
F. terminalis (Plate)			*	# *	*	*	# *	*
Hexarthra mira (Hudson)	•							
Kellikottia longispina Kellikott	# * •	# * •	# * •	# * •	# * •	# * •	* •	# * •
Keratella cochlearis cochlearis (Gosse)	# * •	# * •	# * •	# * •	# * •	# * •	# * •	# * •
K. c. macrachanta (Lauterborn)	•	•	* •	•		•	•	*
K. c. micracantha (Lauterborn)							*	*
K. c. tecta (Gosse)	# * •	# * •	# * •	# * •	# * •	# * •	# * •	# * •
K. hiemalis (Carlin)		•						
K. irregularis (Lauterborn)			•					
K. quadrata quadrata (O.M.F.)	# * •	# * •	# * •	# * •	# * •	# * •	# * •	# * •
K. q. frenzeli (Eckstein)		•			•		•	•
K. testudo (Ehrb.)		*	•	•	* •	•	* •	# •
K. tropica Apstein		*		#	•	•		
K. valga (Ehrb.)	# *	# *	# *	# *	# *	# *	# * •	*
K. v. aspina Edmondson et Hutchinson					#			
Lecane bulla (Gosse)	*	•	* •	*	* •	# * •	* •	* •
L. closterocerca (Schmarda)					*		# *	*
L. flexilis (Gosse)	#					#		
L. ludwigi (Eckstein)			•					
L. luna (O.F.M.)	•	* •	•	*	# *	# * •	# * •	* •
L. lunaris (Ehrb.)	* •	•	•	* •	* •	# * •	* •	* •
L. quadridentata (Ehrb.)			•			•		*
L. ungulata (Gosse)								•
L. stichaea Harring	•							
L. stokesii (Pell)	•			•				
Lepadella ovalis (O.F.M.)			•					
L. patella (O.F.M.)		•	# •		•	•	•	*
L. quadricarinata (Stenroos)			#					
Lindia torulosa Dujardin				#				
Mytilina bisulcata (Lucks)				#				
M. mucronata (O.F.M.)			•					
Notholca acuminata (Ehrb.)	# * •	# * •	* •	* •	* •	* •	* •	# * •
N. labis Gosse	#							
N. squamula (O.F.M.)	# * •	# * •	# * •	# * •	# * •	# * •	# * •	# * •
Paradicranophorus hudsoni (Glascott)		#	*			# •		*
Polyarthra dolichoptera (Idelson)	# *	*	*	# *	#	# * •	*	# *
P. major (Bruckhardt)					#		# •	•
P. vulgaris Carlin	# * •	# * •	# * •	# * •	# * •	# * •	# * •	# * •
Pompholyx complanata Gosse	#	#	#	# •	# •	# * •	#	# *
Ptygura melicerta (Ehrb.)			•			#		#
Ptygura sp.	•	•	•			•		
Rotaria neptunia (Ehrb.)	*		*	*	# *	*	*	*
Rotaria sp.		•	* •	* •	•	* •	* •	•
Synchaeta oblonga Ehrb.		*				# *	*	# * •
S. pectinata Ehrb.	# * •	# * •	# * •	# * •	# * •	# * •	# * •	# * •
Testudinella patina (Hermann)	•	# •	* •	* •	# * •	# * •	# * •	* •
Tetramastix opoliensis Zacharias						•		
Trichocerca capucina (Wierzejski et Zacharias)				*	*		# *	
T. cylindrica (Imhof)		*	*	*	# *	*	*	*
T. longiseta (Schrank)				*	*	*	*	
T. pusilla (Lauterborn)	* •	•	•	* •	# * •	# * •	# * •	# * •
T. similis (Wierzejski)		*		*	*	# *	#	#

TAXA	Br	Rj	Rb	Me	Km	Szo	Nm	Bp
Trichotria pocillum (O.F.M.)		•		*	* •		* •	# * •
T. tetractis (Ehrb.)			*			# *		
T. truncata (Whitelegge)		#			#			
COPEPODA								
C y c l o p o i d a								
Acanthocyclops robustus f. limnetica (Sars)	* •	* •	•	•	* •	•	* •	# * •
A. vernalis (Fischer)	# *	# *	# *	# * •	# *	*	# *	# *
Cyclops strenuus strenuus Fischer			#	#	# * •	* •	*	#
C. vicinus vicinus Ulianine	# *	# *	*	# *	*	# *	*	# *
Diacyclops bicuspidatus (Claus)						#		
Eucyclops macruroides (Lilljeborg)		•	•	•				
E. macrurus (Sars)	•			•			*	
E. serrulatus (Fischer)	•	*		# *		*	*	*
E. speratus (Lilljeborg)		*					*	*
Macrocyclops albidus (Jurine)		*						•
Megacyclops viridis (Jurine)						*	# •	
Mesocyclops leuckarti (Claus)	* •	# * •	* •	# * •	# * •	* •	# * •	# * •
Paracyclops fimbriatus (Fischer)					#			
Thermocyclops crassus (Fischer)				*	*			
T. oithonoides (Sars)	*	* •	# * •	# * •	# * •	# * •	# * •	# * •
C a l a n o i d a								
Eudiaptomus gracilis (Sars)	# *	# * •	# * •	# *	# * •	*	# *	* •
Eurytemora velox (Lilljeborg)	* •	•	•	•	•			
CLADOCERA								
Alona affinis (Leydig)		•		•	*	*	*	
A. costata Sars				*		#		
A. guttata Sars			#	#				
A. intermedia Sars							#	
A. quadrangularis (O.F.M.)	#	# * •	# * •	*	* •	*	# *	*
A. rectangula Sars	* •	# * •	* •	# * •	# * •	* •	# * •	# * •
Alonella nana (Baird)	•				#			
Bosmina coregoni Baird	•	#		# *	# * •		# *	
B. longirostris (O.F.M.)	# * •	# * •	# * •	# * •	# * •	# * •	# * •	# * •
Ceriodaphnia pulchella Sars		#	# *					
C. quadrangula (O.F.M.)							#	
Ceriodaphina sp. juv.		•	•					
Chydorus sphaericus (O.F.M.)	#	* •	# * •	# * •	# * •	# * •	# * •	# * •
Daphnia cucullata Sars	* •	# * •	* •	* •	* •	# * •	*	# * •
D. galeata Sars em. Richard			*					*
D. hyalina Leydig	#	#	*	# * •	# * •	* •	*	
D. longispina).F.M.	# * •	# * •	# * •	# * •	# * •	# * •	# * •	# * •
D. magna Staus	•	•		•				
Diaphanosoma brachyurum (Lievin)	# *	# *	# *	# * •	# * •	# * •	* •	# * •
Disparalona rostrata (Koch)	#	# * •	* •	# * •	# * •	# * •	# * •	#
Graptoleberis testudinaria (Fischer)			#					
Iliocryptus agilis Kurz				#	#	*	#	
I. sordidus (Lievin)						# *		
Leydigia acanthocercoides (Fischer)					*			

TAXA	Br	Rj	Rb	Me	Km	Szo	Nm	Bp
L. leydigi (Schoedler)					*			
Macrothryx hirsuticornis Norman et Brady	# *	•	•	* •	* •	•		
M. laticornis (Jurine)				#	#	#	#	
Moina micrura Kurz		*	•	# *	•	* •	* •	*
Monospilus dispar Sars	#							
Peracantha truncata (O.F.M.)			•					
Pleuroxus aduncus (Jurine)	*	•	•	*	* •	* •	*	# *
P. trigonellus (O.F.M.)					*			
P. uncinatus Baird					# *			
Scapholeberis mucronata (O.F.M.)	•		# •	•	*			
Sida crystallina (O.F.M.)			#		•			
Simocephalus vetulus (O.F.M.)	#	#	# •		*	*		*

Legends: # – Investigations in the year 1992., * – Investigations int the year 1993, • – Investigations in the year 1994.
Br – Bratislava middle stream, Rj – Rajka right side, Rb – Rajka left side, Me – Medve middle course,
Km – Komárom middle stream, Szo – Szob middle stream, Nm – middle stream at Nagymaros, Bp – Budapest Surface Water Works, left side

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